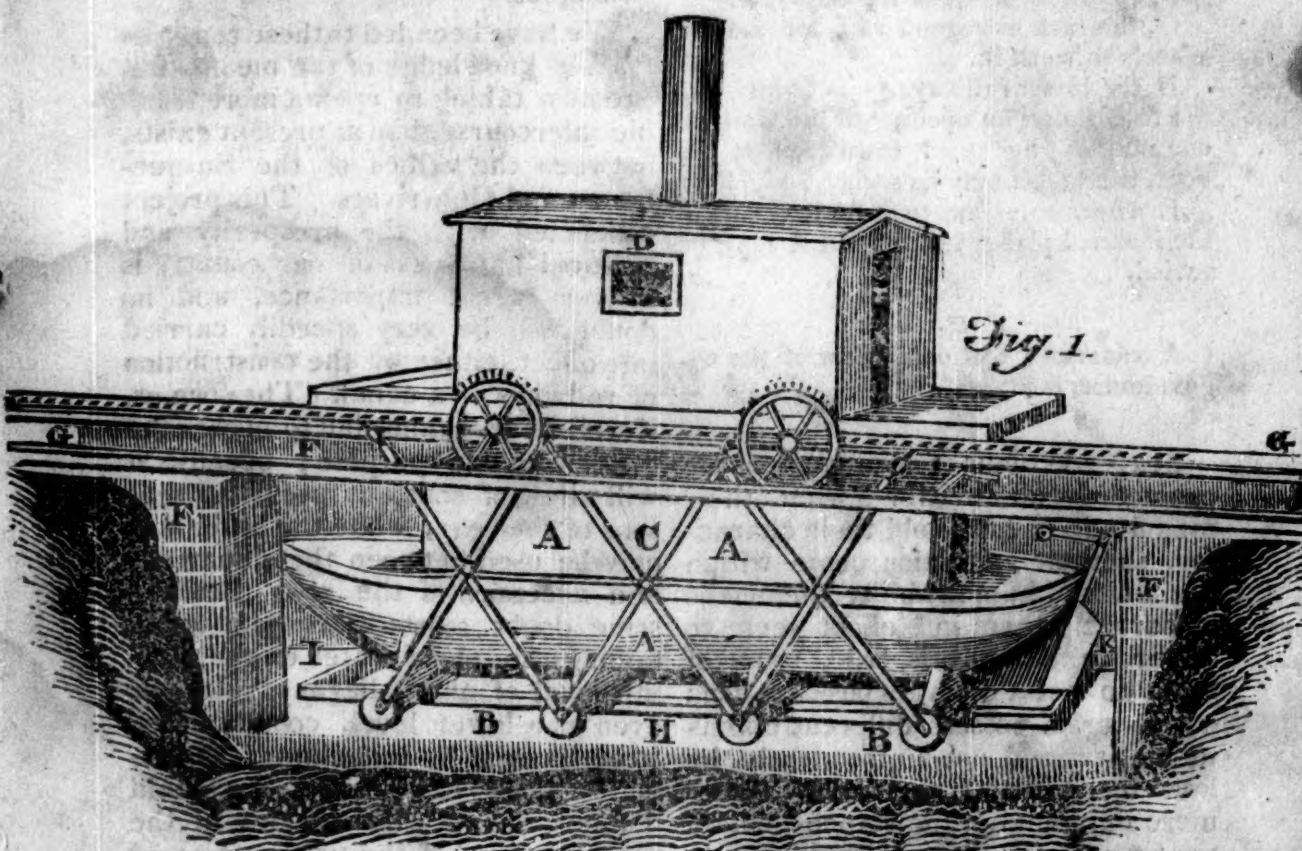
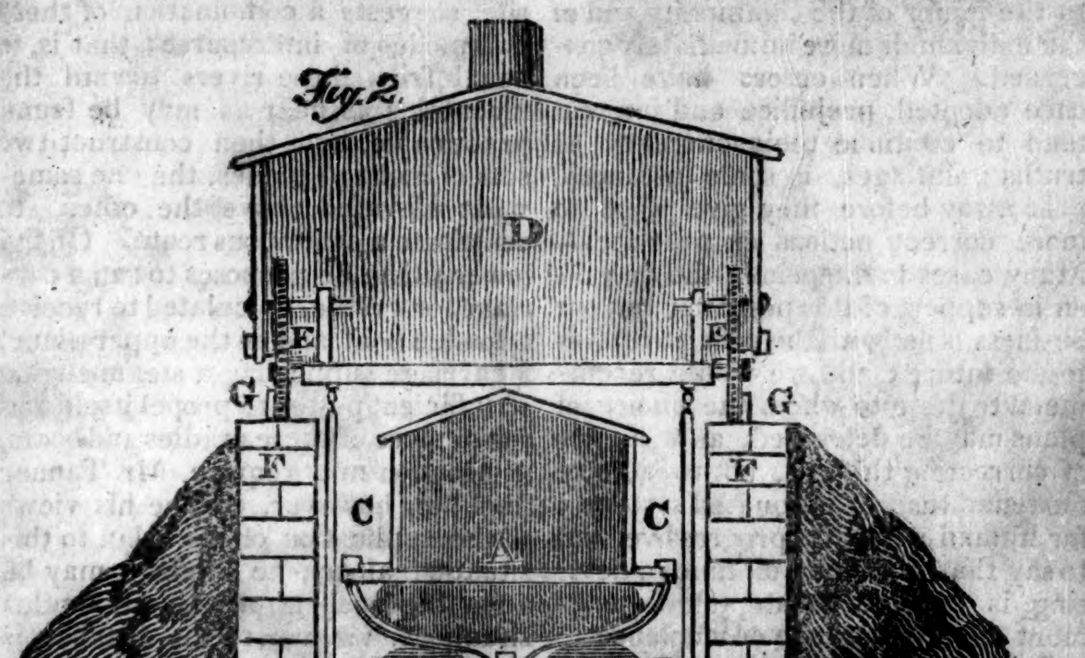
AMERICAN
MECHANICS' MAGAZINE,
Museum, Register, Journal, and Gazette

Vol. II.—No. 28.] SATURDAY, AUGUST 13, 1825. [$4 Per Annum.

DOUBLE INCLINED PLANE, AND INLAND BOAT NAVIGATOR, BY STEAM.

By Archibald Tanner, of Pa.





DOUBLE INCLINED PLANE, AND INLAND BOAT NAVIGATOR, BY STEAM.

Description.

Fig. 1.

A, the boat.

B, the truck, or carriage.

C, a manner of fastening the truck to D, the building containing the steam engine.

E, the cog wheels.

F, the outer or upper railway.

G, the rack or cogged rail, for the cog wheels to work in.

H, the lower railway.

I to K shows an opening in the wall, on one side of the upper railway, that the boat, truck, &c. may be seen.

L, a horizontal line, to show the slope of the inclined plane, viz. 6°, but it may be varied.

Fig. 2.

A transverse sectional view of the engine house, boat, &c.

SIR,—As plans of improvement are projected, no matter what their magnitude or how bold their character, so their execution come within the limits of human ability, the means of carrying them into effect seem to be presented. It is true, some of them do not deserve consideration; others again possess different claims to merit: and not unfrequently the less meritorious, presented under more imposing circumstances, obtain precedence in the public estimation, to the injury of the community and of the individuals more immediately concerned. When errors have been once adopted, prejudice and interest tend to continue their currency as truths; and ages, in some instances, pass away before they give place to more correct notions or practice.—Many cases to the point could be given in support of this position; but our business is not with the past, it relates to the future; and we would recommend to those to whom the choice of plans may be delegated, as a means of correcting the evil, not to adhere too tenaciously to antiquated systems; for human wisdom is progressive, and to say that any thing of human devising is perfect, is an acknowledgment of our ignorance or indolence.

To be able to devise or adopt with judgment, implies a thorough acquaintance with the subject; where this does not exist, we find men plodding successively in the same way, without the thought of variation or increased advantage; but in the reverse, which we rejoice to see becoming fashionable, they substantiate their claim to intelligent beings, by conforming their works to rational principles.

We have been led to these remarks from a knowledge of the means that are now taking to open a more feasible intercourse than at present exists, between the vallies of the Susquehanna and Ohio rivers. This project connected with the prosperity and political happiness of our country is of very great importance, and no doubt will be very speedily carried into effect, either by the construction of railways or a canal. The former, if well built, cannot fail to answer the most valuable purpose; because it will allow of constant use at all seasons of the year; while the latter can only be used between the departure and accession of the frost. Besides, some doubt exists in respeet to obtaining a supply of water on the summit level of the Allegany ridge, or even at a lower level, contemplated to be secured by tunnelling. To obviate these difficulties, Archibald Tanner, Esq., who resides in the neighbourhood of the proposed canal site, suggests a combination of these two modes of intercourse; that is, to canal from these rivers toward the mountains as near as may be found practicable, and then construct two sets of inclined planes, the one somewhat elevated above the other, to constitute a continuous route. On the lower plane he proposes to run a carriage, or cradle, calculated to receive a loaded boat, and on the upper plane, a carriage supporting a steam engine of sufficient power to propel itself and one or more of these cradles and boats, as occosion may require. Mr. Tanner does not, however, confine his views of the application of his plan to this situation alone; he thinks it may be advantageously applied in all similar situations, viz. where the distance is considerable, and water cannot be readily obtained to feed locks and

canals. Where the distance is short, stationary engines would be preferable; but for the purposes designed, we think this plan entitled to a fair experiment. It is certain, its advantages would not be so great in a cold region as in a mild, but where the intercourse fluctuates with the seasons, as is the case between these rivers, its partial interruption during the dominion of the frost, would be productive of less real than nominal injury. Locomotive steam engines are pretty extensively applied on railways to propel loaded carriages in England at this time, and a single one moves with ease and rapidity thirty, and even forty tons; hence we only have to strengthen the railways and machinery, and increase the power of the engine, and all the requisites of Mr. Tanner's plan will be accomplished.

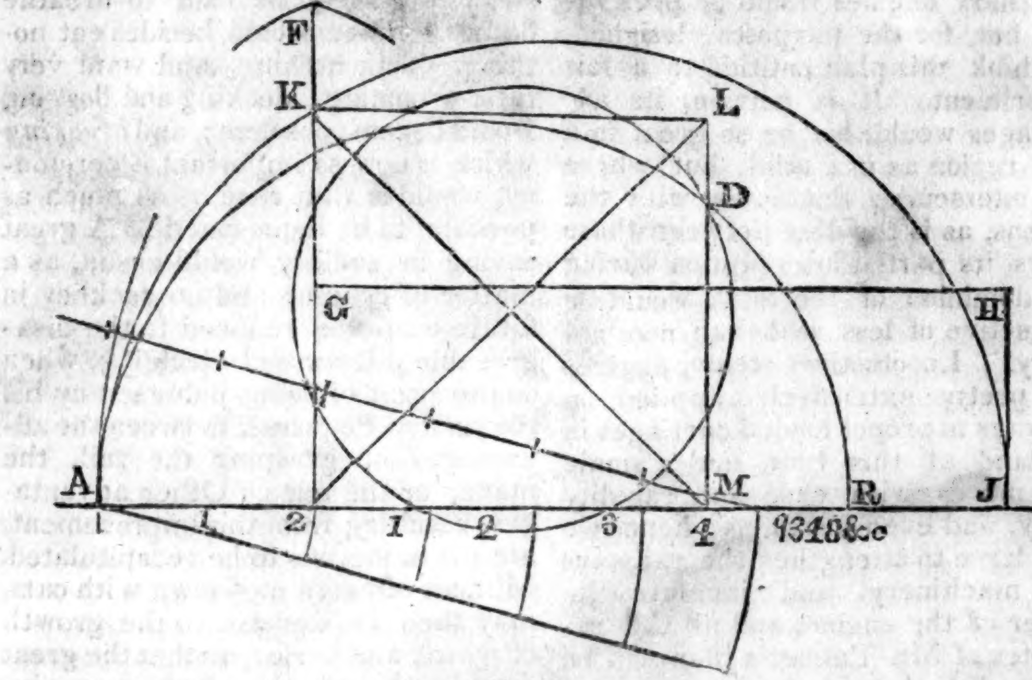
For a farther illustration of this project, we refer to his drawing and description, which precede our remarks.—Ed.

ON STEAM HORSES.

Why confine the advantages of steam to carriages? Why should not steam horses be constructed? Why should we not have new clavilenos with pegs for guiding them, and valves for exciting or abating their mettle? Sunday clerks, in Rotten Row, will no longer from necessity, but choice, sport nags of neither bone nor blood, and braziers may at once supply our dandies with their spurs and "copper fillies:" a farrier may turn his hand to making horses instead of shoeing them; and a blacksmith's shop may supersede the mews, and the horse mart. Instead of a horse eating his head off, as is now too often the case, the horse, without any imputation on his good qualities, may be as deficient in head as his rider; and the riders who are now too liable to be *smoked* themselves, might then be in a capacity to smoke every body else. Such horses, besides being entirely free from vice, would be as pre-eminent in *metal* as in *fire*. The divine horses celebrated by Homer or by romance writers, could not with more strict propriety be said to breathe flames. They would besides eat nothing, drink nothing, and want very little grooming; docking and flogging would become obsolete; and *breaking* which is now so important a ceremony, would in that case be as much as possible to be deprecated. A great saving in sadlery would ensue, as a matter of course; and no cockney in future would be reduced to the disagreeable dilemma of deciding, when on the point of being unhorsed by his too restive Pegassus, between the advantages of grasping the tail, the mane, or the reins. Other advantages, resulting from this improvement, are too numerous to be recapitulated. Millions of acres now sown with oats, may then be devoted to the growth of wheat and barley, so that the great abundance of the first may induce the cheap bakers to desist from making their bread of *ground Derbyshire* stone, alum, potatoes, &c. &c.; and the mere cheapness of malt tempt the "genuine malt and hop" brewers to make their beer of it instead of quassie, coculus Indicus, foxglove, and deadly nightshade. The "ill treatment of Animal's Bill" may be rendered a dead letter by the invention of steam jackasses; the ear would no longer be stunned, and the nose poisoned by the respective cries and exhalations of "dog's meat," and "cat's meat." An office clerk might occasionally dine upon sausages for sixpence, (in order to save a Sunday's treat with his sweetheart at Hockley in the Hole or the Yorkshire Stingo,) without fearing a nightmare vision from the unfortunate animal he had partly embowelled. There would be no farther occasion for a patrician to over-exert himself in learning at College how to be a coachman; the nobler animals on the race courses, and in the mail coaches, might be spared the costly exploit of running against time; and apothecaries and dancing-masters, who now keep a carriage with one horse, might then be enabled to keep one with no horse at all.

Lond. Mec. Jour.

EXTRACTION OF THE SQUARE ROOT.



Sir,—The diameter and periphery of a circle, with the side of a square which shall be equal in area to the circle, are lines incommensurable to each other; it would be therefore quite a hopeless speculation to attempt expressing their proportions in our common arithmetical notation. The decimal fraction, 3,141529654589, &c. has been carried on to thirty-six places of decimals by the celebrated Van Culen, in his attempt to find the length of the periphery of a circle, the diameter of which is unity: but, if he had continued his extractions until they equalled in length the diameter of the orbit of Saturn, the faction would still be but an approximation to the truth.

Permit me to lay before you a diagram, which, if perfect, would give, if not the exact truth, the nearest approximation to it yet made. Being a young geometrician, it may be presumption to aspire to perfection, but such is the idea I would wish to inculcate.

If we take the fraction alluded to, viz. 3,14159 65359, and multiply it by itself, a part of the product will be a surd number, the true square root of which can never be extracted perfectly by any arithmetical process, the product will be 9,8696044010906577598881.

Observe, the terminating figure of the original fraction above is too great, being, substituted for 89, which would be minus; therefore, as the root is greater than truth, the square must also be greater; let us cut off the ten decimals on the right hand, and retaining those on the left, let us extract the square root.

9,86,96,04,40,10,90 (3,14159265
61 86
624 2596
6281 10004
62825 372340
628309 5821510
6283182 16672990
62831846 410662600
628318525 3367152400
225559775

We have now obtained nine figures of the root with a remainder which would give the next quotient figure greater than 3, if we could express it. We are now as much at a loss as ever to express the length of the periphery in arithmetical terms; but we are told by Euclid, that a perpendicular let fall from any point in the periphery of a semicircle, will be a mean proportional between the two segments into which the diameter is divided by the intersection of the perpenpdicular. Now, we

have reason to think that 9,8696044090 is the true quantity, the square root of which is the periphery of a circle which has unity for its diameter.

Let us divide

$$\frac{9,8696044090}{2}=4,9348022045$$:—now, on reference to our diagram, we find the line AB the diameter of a semicircle, and it is divided at E into 2 + 4,9348022042; and from the point F, in the periphery, is let fall the perpendicular line FE, dividing the diameter into two segments;—therefore the perpendicular EF is the true geometrical mean proportional between the two segments, or, in other words, the true and perfect square root of their product 9,8696044090, which, if we attempt to extract arithmetically, we shall obtain a circulating decimal which can never terminate.

We have now, in the perpendicular line EF, the rectilineal magnitude of the periphery of a circle, the diameter of which is unity, and we have that unit in one of the six equal parts into which a portion of the diameter is divided, of which AE is two, therefore two diameters; the parallelogram, EGHI, has two peripheries in length, and its altitude is two diameters, therefore its area is equal to that of the circle which has four for its diameter; for half the diameter, multiplied by half the periphery, gives the area of the circle.

We learn also from Euclid, that if we produce the base of a parallelogram, and add to its altitude, then bisecting the whole line, and making one half of its radius describe a semicircle, the periphery shall cut a perpendicular line raised at the point of junction of the base and altitude, which line (EK, so cut at K) shall be the side of asquare equal in area to the parallelogram. By such means the square, EKLM, has been formed, and therefore may be demonstrated to be equal to the parallelogram; but the parallelogram was made equal to the circle by construction, therefore the square is equal to the circle. If we multiply the square of the diameter by one-fourth of the periphery of unity, we obtain the area of the circle; therefore,

$$\frac{3,14159\ 65}{4}=,7853981625,$$

$$7853981625 \times 16 = 12,5663706 = \text{area of circle,}$$

$$2\text{ peri. }6,28318530 \times 2\text{ diam.} = 12,5663706 = \text{area of parallelogram,}$$

$$\text{side }3,544 + \times 3544 + \quad = 12,5663706 = \text{area of square.}$$

The radius of the cirnle is 2; the diameter 4.

I fear I have worn out your patience, but hope that I have made myself understood. Should you deem this effusion of an untaught philosopher worthy a place in your very useful publication, I should feel pleasure in seeing my humble name appear as one of your contributors.

I trust some of your enlightened Correspondents will favour us with their opinions.

RICHARD DOWDEN.

Cork, September 1, 1825.

Lond. Mec. Mag.

ENGRAVING ON STEEL PLATES.

The earliest known specimens of prints printed from steel plates, are four plates etched by Albert Durer, one of which has the date 1510 inscribed upon it. The hardness of steel, blunting and destroying the tools, seems to have prevented this art from being prosecuted.

Mr. Raimbach, a few years ago, attempted to revive the art of engraving upon steel, and executed an engraving on a thick plate of steel; but met with so many difficulties in the attempt, that it was not followed up.

The late Mr. Warren, having been employed, in his early youth, in engraving upon metals for the use of calico printers or gunsmiths, was induced to apply himself to finer specimens of the art and upon steel. Mr. Gill suggested to him, that the method used by the manufacturers of Birmingham for producing ornamental snuffers, was to roll the steel into sheets, and then reduce it to the state of very pure soft iron. In this soft state the article was easily manufactured, and the ornamental work being engraved or impressed on the surface, the iron was again reduced to steel, at least superficially, by cementation with the proper materials, and was thus rendered capable of acquiring the highest degree of polish.

In attempting to apply this method of reducing steel plates to soft iron, and then using them for the purpose of engraving, a considerable difficulty was met with, whether the plate was thin or thick.

In case of a thin plate being used, and any error is committed in the engraving

it may indeed be scraped out, and, by striking the under side of the plate with a punch and hammer, the cavity occasioned by the scraping may be raised to the general level of the plate; but, in return for this facility of correcting the errors of the artist, it was found that the thinness of the plate requisite for this purpose was accompanied with the fault of being very liable to become warped in the reduction of the softened plate to the state of steel by cementation, and thus rendered incapable of giving perfect impressions.

If in order to avoid this disadvantage blocks of three or four times the ordinary thickness were used, the warping indeed was prevented; but, in return, a still greater difficulty was found to take place, for the process of knocking up was rendered impracticable; and it was necessary, in order to remove an error or defective part, to grind out the surface, or to drill a hole from the under surface, almost through the plate, and then, by forcing in a screw, to raise that part of the face immediately above it; a very tedious and difficult process.

Each of these opposite ill qualities of thin and thick plates, detracted considerably from the expediency of substituting steel for copper.

While the idea of this substitution was in agitation, it became an interesting object to ascertain how many impressions might be taken from a plate of steel: 5000 impressions were taken from a plate of steel executed by Mr. Warren, for an edition of Mackenzie's Works, which exhibted, both in the landscape and in the figures, the most elaborate and delicate work, and yet it was impossible to detect any perceptible difference between one of the first and one of the last impressions. The case was the same when 4000 impressions were taken of another plate, for an edition of Beattie and Collins.

Mr. Warren making no secret of his mode of preparing the plates, the engraving upon steel was practised by other artists; 25,000 impressions having been taken of some plates for the Evangelical Magazine, the plates remained in a good state. Such indeed was the durability of the plates, that in one instance Mr. Warren did not take his own proofs until after 3,000 impressions had been taken off the plate; and in another instance, of a portrait, not till after 20,000 had been taken.

Mr. Warren's mode of converting the steel into soft iron, for the purpose of engraving, was to cover the bottom of an iron box, of a proper size, with a mixture of iron turnings and pounded oyster shells; on this a steel plate was laid, another bed of the mixture was then added, and so on alternately, till the box was full, taking care that the uppermost bed should be of the decarbonizing mixture. The box was then placed in a furnace, and kept for several hours at the highest heat it would bear without melting; when cooled, the steel was found, for the most part, decarbonized into soft iron. The steel, however, does not, in this mode of decarbonization, always turn out sufficiently and uniformly soft, particularly if wanted for the purposes of the mezzotinto engraver.

Mr. Hughes, a copperplate engraver, imagining that this defect was owing to a deficiency of heat, therefore enclosed his plates in a cementing pot of clay; and by applying a much greater heat than the cast iron cementing box would bear without melting, he obtained, by two or more cementations, plates so very soft that they might be bent over the knee. The plates generally warp in the first cementation, they must therefore be made flat by a mallet, with as little force as possible; because the places which are forcibly struck with a hammer, are apt to be less softened than the other parts in the second cementation.

The softened plate is then to be cleaned and polished, but not too highly; and afterwards being less heated than is usual with copperplates, is to be covered rather thickly, in the usual manner, with the engraver's soft varnish. Should the plate be overheated, or too highly polished, the etching ground, as it cools, contracts, and presents a honeycomb surface, and leaves some parts uncovered.

Nitric acid, much more diluted than for copperplates, may be successfully used for corroding the lines. A solution of quicksilver in nitric acid blunts or rounds the edges of the lines. Acetic acid, with a small proportion of a solution of copper in nitric acid, produces the same effects. A solution of sulphate of copper (blue vitriol) in water, bit in the light tints very beautifully; but its farther action rendered the lines rough. The best liquor for corroding the plate is a solution of half an ounce of crystallized nitrate of copper in a pint and a half of distilled water, sharpened with a few drops of nitric acid. It will be necessary, when a solution of salt of copper is used, to sweep the lines conti-

nually, and particularly their ends, with a camel hair brush, to remove the reduced copper.

In stopping out the lighter tints with Brunswick black, the stopping must be laid on very thin and smooth on the edge, or the copper will be retained, and render the work foul; the only inferiority in the use of steel plates is, that the process of rebiting has not as yet been carried to such perfection as with copper.

Might it not be advantageous to revive the process of only drenching the plates, placed on one of their shortest sides, in a narrow trough, supported by an easel, in the manner described by the old authors, for corroding plates when the engraver's hard varnish is used?

Lond. Mec. Jour.

ON MADDER AS A DYE DRUG.

Madder, a substance very extensively employed in dyeing, is the root of the rubia tinctorum; placed by Linné in his class and order tetrandria monogynia; and by Jessieu, in his family rubiaceæ, named from this plant.

Although madder will grow both in a stiff clayey soil and in sand, it succeeds better in a moderately rich, soft, and somewhat sandy soil; it is cultivated in many of the provinces of France, in Alsace, Normandy, and Provence, the best European growth is that which comes from Zealand. Although often attempted to be grown in England, its cultivation has not succeeded here.

The best roots are about the thickness of a goose quill, or at most of the little finger: they are semi-transparent, and of a reddish colour, with a strong smell; the bark is smooth.

Hellot ascribes the superiority of the madder which comes from the Levant to the circumstance of its being dried in the open air.

The red colouring matter of madder may be dissolved in alcohol, and on evaporation a residuum of a deep red is left. Fixed alkali forms in this solution a violet, the sulphuric acid a fawn coloured, and the sulphate of potash a fine red precipitate.—Precipitates of various shades may be obtained by alum, nitre, chalk, sugar of lead, and the muriate of tin.

The quantity of oxymuriatic acid required to destroy the colour of a decoction of madder, is double what is necessary to destroy that of a decoction of an equal weight of Brazil wood.

Wool would receive from madder only a perishable dye, if the colouring particles were not fixed by a base, which occasions them to combine with the stuff more intimately, and which in some measure defends them from the destructive influence of the air. For this purpose, the woollen stuffs are first boiled two or three hours with alum and tartar; after which they are left to drain; they are then slightly wrung, put into a linen b[illegible], and carried into a cool place, where they are suffered to remain for some days.

The quantity of alum and tartar, as well as their proportions, vary much in different manufactories. Hellot recommends five ounces of alum and one ounce of tartar to each pound of wool. If the proportion of tartar be increased to a certain degree, instead of a red a deep and durable cinnamon colour is produced; because, as we have seen, acids have a tendency to give a yellow tinge to the colouring particles of madder. Berthollet found that by employing one half tartar the colour sensibly bordered more on the cinnamon than when the proportion was only one-fourth of the alum.

In dyeing with madder, the bath must not be permitted to boil, because that degree of heat would dissolve the fawn coloured particles, which are less soluble than the red, and the colour would be different from that which we wish to obtain.

The quantity of madder which Mr. Poerner employs is only one-third of the weight of the wool; and Schæffer advises only one-fourth.

If wool be boiled for two hours with one-fourth of copperas, *i. e.* green vitriol, then washed, and afterwards put into cold water, with one fourth of madder, and then boiled for an hour, a coffee colour is produced. Bergman adds, that if the wool have not been soaked, and if it be dyed with one part of copperas and two of madder, the brown obtained borders upon a red.

Berthollet employed a solution of tin in various ways, both in the preparation and in the maddering of cloth. He used different solutions of tin, and found that the tint was always more yellow or fawn coloured, though sometimes brighter than that obtained by the common process.

Mr. Guhliche describes a process for dyeing silk with madder:—For each pound of silk he orders a bath of four ounces of alum and one ounce of a solution of tin; the liquor is to be left to settle, when it is to be decanted, and the silk carefully

soaked in it, and left for twelve hours; and after this preparation, it is to be immersed in a bath containing half a pound of madder, softened by boiling with an infusion of galls in white wine; this bath is to be kept moderately hot for an hour, after which it is to be made to boil for two minutes. When taken from the bath, the silk is to be washed in a stream of water, and dried in the sun. Mr. Guhliche compares the colour then obtained, which is very permanent, to the Turkey red. If the galls be left out the colour is clearer. A great degree of brightness may be communicated to the first of these, by afterwards passing it through a bath of Brazil wood, to which one ounce of solution of tin has been added; the colour thus obtained, he says, is very beautiful and durable.

The madder red of cotton is distinguished into two kinds; one is called simple madder red; the other, which is much brighter, is called Turkey or Adrianople red, because it comes from the Levant, and has seldom been equalled in brightness or durability by our artists.

Galls or sumach dispose thread and cotton to receive the madder colour; and the proper preparative is acetate of alumine. The nitrate and muriate of iron, as preparatives, produce a better effect than the sulphate (green vitriol) and acetate of the same metal: they both produce a beautiful and well saturated violet colour.

Lond. Mec. Jour.

MR. HENRY MARSHALL'S IMPROVED MELTING POTS.

The use of crucibles, or melting pots, in various manufactories, is so great, that any improvement in them must be very important to the various workers in metal, who use them in great quantities. They are now made in London, Birmingham, Sheffield, and other places, and their ingredients are tenacious refractory clay, mixed together with fragments of earthenware, made of similar clay, reduced to powder, more or less coarse, according to the experience of the manufacturer. It is not necessary that they should for common purposes be possessed of the highest degree of refractoriness, since the heat to which they are exposed is not so great, nor are the fluxes used by the founders so active as are employed by the assayers and chemists for the reduction of metallic ores to their regular state; but it is especially expedient, that they should be capable of enduring considerable changes of temperature without cracking or becoming unsound, as otherwise each pot would not be capable of standing more than a single fusion. The common melting pots being made entirely of earthy ingredients, are very apt to crack, either if allowed to cool gradually after the first fusion, or if a second charge of cold or nearly cold materials is thrown in while the pot remains heated.

The German black lead pots contain a considerable quantity of plumbago in their composition, and hence will stand a great number of fusions; but the cost of these is considerably greater than the common melting pots, and in time of war they are not always to be had.

But the improvent we have to notice has been made by Mr. Henry Marshall, of Newcastle-upon-Tyne. His crucibles are made of a mixture of Stourbridge clay, pothsherds and powdered coke, well incorporated together by beating, and instead of being thrown on the potter's wheel, the pot is made by pressing the above composition into a brass mould, of the proper size and figure, by means of a core worked by a powerful screw press. Thus the vessel acquires a great and equal degree of solidity throughout the whole, while the intermixture of coke with the clay, by giving the mixture a certain porosity of texture, renders it much less liable to crack on passing from a hot to a cold state, or vice versa, than those melting pots which are composed entirely of earthy ingredients.

Lond. Mec. Jour.

ON THE MANUFACTURE OF CHIP HATS.

Chip Hats are manufactured on the same principles as those of straw, the chips being generally plaited in the same manner, although sometimes they are interwoven in the manner of basket work, particularly the common kind used by the

country people. The only particularities are the methods adopted to obtain the chips, and the manner of whitening them.

As to the first, the wood usually chosen for this manufacture is that of the lime tree, poplar tree, willow tree, and some others, which have a white wood without knots. The wood is taken green, and divided into very fine chips by means of a plane with two irons. The first plane iron is furnished with several cutting teeth, and the second has as usual a plain chisel edge; of course the shavings are divided lengthways into as many slips, and one more, as there are teeth in the first plane iron. The plane is pushed forward between guides placed for that purpose, in order that the teeth may always repass in the same place. Several machines have been invented for the cutting of these chips; but this double iron plane is the simplest, and perfectly answers the purpose for which it is intended.

The chips are whitened, or the hats, after they are made, by soaking them in cold soap water, with a little stone blue among it; after which they are exposed for some days on the grass, taking care to sprinkle them with clear water as often as they grow dry.

These chips, or the hats made from them, may be dyed in the same manner as straw plait or straw hats.

In France they have introduced a kind of stuff, the woof of which is formed of willow chips, and the warp partly of willow chips, partly of whalebone, two of the former and then one of the latter, alternately throughout the piece. Hats are made of this stuff, which may be dyed of any colour, but gray is the most usual. *ib.*

ON PRODUCING FLAT SURFACES OF METAL.

Considerable difficulty occurs in obtaining perfectly flat surfaces of metal; such, for instance, as a flat plate for the purpose of supporting the receivers intended to be exhausted of air, by the means of an air-pump.

The best method at present known, is to turn them, by means of the slide rest, in the lathe, to a straight edge. These plates are then to be finished by grinding several of them, not less than three, one upon another by turns, with emery and water, in the same manner as the opticians use in grinding their lenses.

Unless several of these flat plates be prepared at once, it is difficult to avoid making them convex or concave; the leas tendency to which fault must be counteracted on the very first appearance.

In the case of any of these plates becoming convex, it must be turned again in the lathe, in order to restore its flatness.

On the other hand, when any two of them may chance to become slightly concave, their flatness must be restored by grinding them together. *ib.*

MR. ROBERT FORD'S CHEMICAL LIQUID, OR SOLUTION OF ANNOTTO.

An alkaline solution of annotto has long been used under the name of the nankeen dye; and a Mr. Ford has taken out a patent for a similar article under the above name.

His chemical liquid is described as being made of 56lbs. of annotto, reduced down by warm water, then passed through a fine sieve, and let to stand for a week, or longer. A sufficient quantity of a solution of pearlash in water is then added, to produce the intended shade of colour, or other suitable articles may be used for this purpose. He then adds to the above six pints, more or less, of what he calls aqua lixivium caustic, by which he probably means soap ley, and 192 ounces of spirit of wine. These being all mixed together, the mixture is to be kept in a closed vessel.

He claims his patent-right to be the production of any liquid or solution of annotto, prepared either by the above or any other means whatever; and hence he does not seem to be aware of the composition of the nankeen dye, which has been so long sold in the shops. *ib.*

MR. BENJAMIN COOK'S PATENT MIXTURE FOR PREVENTING FIRE.

This patent is merely for the impregnating of the different combustible substances, as timber, curtains, and the like, with a dilute solution of potash or pearlash in plain water; generally in the proportion of twenty-five gallons of water to each cwt. of alkali, for timber, but for cotton, paper, silk, linen, and similar articles, he adds alkali to the water until the articles, being dipped into the solution and dried, will not blaze, but merely char.

In rendering new timber incombustible, he would extract the sap from the new fallen tree, before it is barked, by means of an engine, and then saturate the timber with the alkaline solution, after which the tree may be barked, and sawed up.

For timber already cut up and used in building, he washes it over four or six

times with the alkaline solution, and lets it dry between each washing.

For linen, and similar articles, he washes them, then wrings them, dips them in the solution, again wrings them out as dry as possible, after which they may be ironed or mangled.* *ib.*

MR. HARRIS'S SYRINGES FOR OIL COLOURS.

The oil colours used by painters are generally sold in bladders, which, as long as they keep entire, preserve them in a state fit for use. The colour, as it is wanted, is got out by pricking the bladder and then squeezing it until the quantity required for present use is expelled; but the air is absorbed, although slowly by the colour through the hole thus made in the bladder, and thus renders the colour thick and unfit for use. Some colours are kept under water; but this mode cannot be used with Lakes or Prussian blue, or any compound colours into which these colours enter as an ingredient, for they are very liable to become ropy, and no longer serviceable; which indeed happens to them when kept in bladders.

Mr. Harris has therefore proposed the use of tin syringes, or brass syringes tinned on the inside, as being not only a more cleanly mode of keeping the colours, but also of more perfectly excluding them from the action of light and air—to say nothing of the keeping the colours from mixing together, which frequently takes place when the bladders containing them get torn by use.

Several artists have expressed their approbation of these syringes, as keeping the colours in a fit state for use, and in a more cleanly and less wasteful manner than usual; inasmuch as Lakes and other tender colours may be kept in them without spoiling.

The syringes used by Mr. Harris have a small cap to screw on their pipe, to prevent the access of air; the piston part is merely a cork covered with leather, with a plate of metal at bottom, having two wires fixed in it, bent into rings at the upper part, and screwed into the metal plate, so that a double hook of strong wire being made to lay hold of these rings will pull out the cork, and thus enable the artist to replenish the syringe with colour. To push this cork down the barrel, and thus force the colour out at the end of the pipe, a cap is screwed on the top of the barrel, having in the centre a female screw, in which the piston, formed in a male screw, turns, and thus pushes down the cork.

This construction was probably adopted to prevent the piston being accidentally pushed down, and the colour thus forced out; but the screw pistons of the syringes which have not had much of their colour used, must be in the way; and there appears no reason why a single plain piston-rod might not be used to push down the pistons of all the syringes containing the several colours used by the artist.

The use of the syringe for keeping colours is patronised by several of the most esteemed painters in London, as Sir Thomas Lawrence, Mr. King, Mr. Collins, and others.

Lond. Mec. Jour.

ON THE WEIGHT ACQUIRED BY LIME.

Bishop Watson found, by experiment, that every ton of limestone produces 11cwt. 1qr. 4lbs. of quick-lime, when this lime was weighed hot from the kiln.

By exposure to air, however, each ton of quick-lime increased in weight no less than a hundred weight a day, for the first five or six days after it was taken from the kiln; the increase being partly caused by the absorption of water, but principally by the absorption of carbonic acid gas, formerly called fixed air, and known to miners and well-diggers by the name of choke-damp. By this absorption the quick-lime returns by degrees to its original composition; but altered in its state of mechanical aggregation.

* This slight precaution would prevent the accidents which frequently occur from the combustible character of the dresses usually worn by children in the United States.—ED.

The above rapid alteration in weight claims the attention of those who have to carry lime to any distance: and it may also be worthy of consideration, whether ground limestone may not, in some situations, be furnished cheaper, and be equally efficacious as a manure as quicklime, which must, by its long exposure to air have recovered its carbonic acid gas before it is spread on the ground. *ib.*

BROWN'S GAS ENGINE.

We copy the following impartial observations on the merits of this Engine from the *Scotsman*:—

"A very ingenious paper on this engine appeared lately in a cotemporary paper, (the *Caledonian Mercury*,) and on Wednesday night Dr. Fyfe made some interesting remarks on the same subject, at the close of his lecture in the School of Arts (of Edinburgh.) Before proceeding farther, we may remark, that Mr. Brown's engine has made us acquainted with a fact, which we believe was scarcely known before—the extraordinary rarefaction produced by the sudden combustion of a quantity of gas in a mass of common air. It is upon this, and not upon the condensation of a part of the gaseous fluids, that the power of Mr. Brown's engine chiefly depends; and till the engine itself was exhibited, it was not, we believe, suspected that the momentary effect of the heat evolved in dilating the aerial mass, was one-third part of what it is actually found to be.

"It has been stated in the *Mercury*, that, by mixing 1 part of coal gas with 7 of common air, a vacuum equal nearly to 5 parts was produced, the residuary air occupying three parts of the glass vessel, and this proportion of 1 part of gas to 7 of common air was found to be most advantageous. When oil gas, however, was employed, 1 part of the gas added to 20 of common air was found the most advantageous, and the vacuum formed amounted to 10 parts. In the first set of experiments, therefore, 1 foot of coal gas afforded 10.

"Dr. Fyfe conducted his experiments pretty nearly in the same way, but arrived at results considerably different. He stated that, after many trials, he found that the greatest effect was produced when 1 part of coal gas was mixed with 30 of common air, and that he had sometimes obtained a vacuum equal to 24 parts, though, on account of the nicety of the operations, it was often much less. He repeated the experiment with 1-30th of gas several times in presence of the class, and the vacuum obtained varied from 15 up to 21 parts, the whole contents of the glass being 30. The Doctor considers the vacuum as produced almost entirely by the sudden dilatation of the air; and he has no doubt that, with apparatus properly contrived, a vacuum equal to 24 or 25 parts, that is, to 4-5ths or 5-6ths of the contents of the cylinder, might be constantly obtained. He added, that he has since learned that 1-30th of gas is the quantity actually used by the patentees in London, and that the vacuum produced is nearly what he stated.

"The price of coal gas in Edinburgh is 12s. per 1000 cubic feet in shops. But this price covers the great expense of pipes, the loss from breakage, and the profits of the manufacturer. Dr. Fyfe stated, that the prime cost of the gas was 4s. 11d. per 1000 cubic feet, but that gas sufficiently good for working an engine, extracted from a cheaper coal, and purified by a less expensive process, might be furnished at 2s. 9d., or, taking a round sum, at 3s. Now, assuming that 24 feet of steam per minute afforded a power equal to that of one horse, one foot of gas, yielding 24 of vacuum, should produce the same effect. Hence a pneumatic engine of one-horse power should consume 60 cubic feet per hour, or, in round numbers, 1500 cubic feet per day; the cost of which, at the price mentioned, would be 4s. 6d. It follows, that this expense, though moderate, would be considerably greater than the expense of steam. But still, if by the additional cost we should get rid of the vast and cumbrous machinery of the steam engine, there are cases where it would be highly advantageous.

"Assuming, as previously stated, that 60 cubic feet per hour are equal to a horse power, it follows that 1000 cubic feet would supply a four-horse power engine for four hours. Now, since 30 atmospheres of gas can be compressed into the bulk of one, it follows that a cubical copper vessel, scarcely exceeding one yard each way, would hold the quantity of gas required to work the engine for four hours. The engine itself is said to weigh only one-fifth part of the steam engine. One of four-horse power might consequently weigh something less than a ton, while the locomotive steam-engine of the same power weighs four tons. Were engines of this description, therefore, adapted to locomotive machines, a four hours, or even a six

hours supply of gas could be stowed into the machine, and all the bulky apparatus for manufacturing the gas, with the fuel, and part of the attendance, could be dispensed with. The extra price of the gas, compared with steam (and compressed gas would cost more than gas of ordinary densities) sinks into nothing in a case of this kind, where every ton of stowage gained may be worth 10s. or 20s. per day. If the machine fulfils the promise of its inventor, its value for purposes of this kind will, beyond a doubt, be very great."

A writer in the *Examiner* makes the following remarks What he says of Mr. Brown's delay in furnishing he farther explanations naturally expected from him, is deserving of that gentleman's particular attention.—

"Mr. Brown has never, I believe, published any very exact data; all that I have been able to meet with are, that 'the patentee calculates on raising 200 to 300 gallons of water fifteen feet high, with one cubic foot of gas,' and that the vacuum produced is indicated by 22 *à* 24 inches of mercury: Dr. Fyfe says 24 *à* 26 inches.

"Now, allowing gas made on the spot to cost 5s. per 1000 cubic feet, 300,000 gallons may be raised 15 feet for 5s. without regard to time. In doing this, the water is admitted at once into the vacuum chamber, in the manner of Savery's, or rather Kier's steam engine, and there is no loss of power from complicated machinery; but supposing the vacuum perfect, the the utmost height is only about 33 feet, and therefore this plan is of limited application; whereas, at some of the water works, upwards of 150,000 gallons are raised per hour against a pressure equivalent to a column of 120 feet, at a cost of less than 5s. for fuel, which is equal to 1,280,000 gallons per hour through 15 feet, and this notwithstanding the complication of machinery necessary to work a forcing-pump.

"From such loose information it is almost impossible to ascertain the ratio that the gas consumed bears to the vacuum obtained, but it cannot be less than 2 per cent.; assuming that ratio the application to an engine of small power will not at first appear so disproportionate. A six-horse engine has a piston of 14½ inches diameter, a stroke 2 feet 4 inches long, and makes 40 strokes or 80 exhaustions in a minute, and consequently requiring 12,843 cubic feet of vacuum per hour, consuming about 45 pounds of coals, at most three-quarters of a bushel, which, at 42s. per chaldron, would be 10½d. per hour; whereas the gas, at 2 per cent. would be nearly 257 cubic feet, and would cost 1s. 3½d. But the power of gas will not come nearer to steam than 12lbs. to 16lbs. on the square inch, after deducting for the air-pump of the steam-engine, therefore a proportionate increase of capacity and expense will be required to equalize the power; the gas would therefore be 342½ cubic feet, and cost 1s. 8½d., nearly twice the cost of steam. But this is supposing the vacuum could be made in the piston cylinder, which, I believe, has never yet been effected, nor is very likely to be: the vacuum is, however, obtained in the piston cylinder by transfer; that is, the cylinder full of air is opened into the vacuum chamber, and its contents equally diffused throughout the two. This method must be productive of great loss of power or gas; if the vessels are equal, one-half of the power will be lost. In one which I have seen constructed by Mr. Frasi, the proportion was 8 to 1; the loss of power was therefore 1-8th. But the cost for gas would be eight-fold, or 13s. 8d., being upwards of fifteen times that of steam. This method of application may be varied, but will always be productive of great loss in some way.

"To the proposition of applying the gas vacuum engine to the purpose of moving carriages, another objection presents itself; the gas must be conveyed in a condensed state: if an engine on the principle above alluded to be used, and it was then proposed to be, it would require either a very large vessel or high condensation. The Portable Gas Company, I am informed, condense 16 times, which gives an expansive force of 40 pounds on the square inch; even with that condensation it would require a vessel of 17| cubic feet every hour.

"As to inertia and friction, I suppose them about equal in both cases.

"If this account should prove erroneous, I believe it will be from want of data respecting the gas engine, which certainly Mr. Brown might have furnished ere now. At any rate, it may serve to give an idea of the manner and necessity of calculating such questions."

Lond. Mec. Mag.

ON THE COFFEE SHRUB, COFFEE BEAN, AND COFFEE DRINK.

The coffee shrub is a plant of the same family as madder, namely, the rubiaceæ of Jussieu, and is arranged by Linné in his class pentandria, and order monogynia. There are several species of coffee; but

the only one cultivated for use, is the Coffea Arabica of modern botanists. It is a native of the Upper Ethiopia, and grows about 14 or 20 feet high: the branches come out in pairs, opposite each other, and crossing the pair of branches that come out below and above them; the leaves are somewhat like those of the bay, but less dry, and thinner; the flowers are white, and succeeded by a berry like a cherry, filled with a yellowish pulp, and two small horn-like beans, flat and grooved on one side, and convex on the other.

It was a few years before 1500 that the infusion of these berries came into use as a drink, and it has slowly extended itself through most parts of the civilized world; except China, England, and Morocco, in which the use of tea is more common than that of coffee drink.

It was probably the elastic horny nature of these beans, which renders them very difficult either to powder or for the water to penetrate, that originally led the users of coffee drink to roast the beans to a brown colour, in order that they might grind them more easily, and extract the virtues of it the more speedily. The roasting not only perfectly answers these purposes, but also developes the aroma, or odorous principle of the coffee bean.

In order to roast coffee properly, the uses of roasting must not be lost sight of, namely, to destroy the horn-like tenacity of the green bean, and to develope its fine scent. Too much heat would destroy the chemical elements which ought to be preserved, and would substitute in their place others which are entirely different in quality. That fine scent, which pleases so greatly the admirer of good coffee, is succeeded, when the coffee is over-roasted, by a bitter taste and burnt smell, which is far from pleasant, and even disagreeable. If, on the other hand, the roasting process is under-done, and the heat to which the beans have been exposed has not been sufficient, then the raw smell of the coffee remains, and of course diminishes the aroma, which requires a certain heat to develope it. There is of course a just medium to be observed. Well roasted coffee ought to have a pale chocolate colour equally spread over it, which is well known to those who are in the use of performing this operation; but it is never necessary to look at the roasted beans, the scent is sufficient; for when the true aroma is developed, and fills the surrounding atmosphere with its delicious scent, then is the time to stop the roasting. After this period, the oil acquires a burnt flavour, a scent somewhat resembling that exhaled by smokers of tobacco is perceived, and instead of good roasted coffee, there is obtained a bad kind of charcoal.

Considering the importance of this operation, it is no wonder that some of those who are very fond of coffee drink, although they would feel ashamed in busying themselves in any other department of household economy, yet do not hesitate to roast their own coffee, not only at home, but even with their own hands. The fragrancy diffused by the roasting seems to delight them. and they appear to enjoy, by anticipation, the pleasure they shall feel in drinking the infusion.

Good raw coffee loses from 16 to 20 per cent, of its weight by roasting; if it loses more it is certainly over-roasted. Many different modes are used, and each has its admirers; but there is in fact only a single rule to be observed, namely, to use the proper degree of heat, and keep it up at the same point until the roasting is finished. Whether the roasting is performed in close or open vessels; whether the coffee is left to cool in the roaster, or is turned out, or even laid between cloths, appears indifferent. If, indeed, the roasting is carried by accident too far, the coffee should be immediately spread out thin on the floor, to cool it as soon as possible. In all cases, when cold, the roasted coffee should be put into tin-plate boxes, and kept from any moisture.

The chemists have made comparative analyses of raw and roasted coffee, of which some account may hereafter be given; but at present there is room only for detailing the best modes of making the coffee drink.

It being well known that the chemical action of solvents is hastened, in general, by reducing the solvent to powder; it is necessary to grind the roasted coffee more or less fine, as it is intended to use the water less or more heated. To reduce coffee to too fine a powder, although it would require only slightly warm water to extract its soluble parts, yet it would be inconvenient in other respects, for the powder would pass through the strainers of the coffee pot, and, by also remaining suspended in the water, would render the clearing of the drink difficult. At all events, roasted coffee should never be ground but the moment before it is used, as otherwise it loses much of its fine scent.

It now remains only to say a few words respecting the making of the ground roasted coffee into drink,—and here the grand points are, not to lose the fine aroma, and not to extract the bitter, acrid, resinous

element of the coffee. To avoid both these inconveniences, it is necessary that the coffee drink should not be made with too much heat; as this would dissipate the aroma in vapours, and cause the water to dissolve the resin. The coffee, therefore, must not be boiled in the water, and still less is it proper to boil the grounds over again with fresh water, as is done by some persons. Coffee drink made from the grounds, when it is added to that made from fresh ground coffee, gives it indeed a fine deep colour, but the taste of the drink is very bad.

It is not even necessary to pour boiling or even warm water upon the ground coffee: cold water, if sufficient time is allowed, makes equally good coffee drink, for the elements to be extracted from the roasted coffee are extremely soluble in water. But if the coffee drink is required to be prepared in haste, hot water must be used.

It is universally agreed on by the French amateurs of coffee, that coffee drink is never so good as when, after being made with cold water, or with hot water and cooled, it is heated over again, carefully avoiding a boiling heat. This heating over again is supposed to cause the various elements which produce the fine flavour of this drink, to unite more intimately; and this may be the real fact. The excellency of the coffee sold at Paris is well known; and this is always made one day and heated over again the next day, when wanted. A further advantage attends this knowledge, of consequence to single persons who, in summer time, do not keep a fire in their chambers, that by merely pouring cold water on the ground coffee over night, and straining it in the morning, the strained liquor may, while they are dressing, be heated sufficiently for drinking, over a lamp; and this gives coffee a superiority over tea for the breakfast of such persons; as tea requires the water to be boiling hot, in order to extract its virtues; and of course requires a fire to be lighted.

Lond. Mec. Jour.

EFFECTS OF FLY-WHEELS.

SIR,—Having, in the course of an extensive intercourse with operative mechanics, frequent occasion to observe that very incorrect notions are entertained with respect to the operation of Fly-Wheels, I have thought that an explanation of the manner of their operation might profitably occupy a space in your pages; and I have, therefore, (in the hope that you will agree with me in thinking it worthy of insertion,) abstracted from an excellent article on the subject by Dr. Brewster, in his "Appendix to Ferguson's Lectures," as much as seems to me necessary to place the whole subject in a simple and clear light before your readers. B. D.

"A Fly, in mechanics, is a heavy wheel or cylinder which moves rapidly upon its axis, and is applied to machines for the purpose of rendering uniform a desultory or reciprocating motion, arising either from the nature of the machinery, from an inequality in the resistance to be overcome, or from an irregular application of the impelling power. When the first mover is inanimate, as wind, water, and steam, an inequality of force obviously arises from a variation in the velocity of the wind, from an increase of water occasioned by sudden rains, or from an augmentation or diminution of the steam in the boiler, produced by a variation in the heat of the furnace; and, accordingly, various methods have been adopted for regulating the action of these variable powers. The same inequality of force obtains when machines are moved by horses or men. Every animal exerts its greatest strength when first set to work. After pulling for some time its strength will be impaired; and when the resistance is great, it will take frequent, though short relaxation, and then commence its labour with renovated vigour. These intervals of rest and vigorous exertion must always produce a variation in the velocity of the machine, which ought particularly to be avoided, as being detrimental to the communicating parts as well as the performance of the machine, and injurious to the animal which is employed to drive it. But if a fly, consisting either of cross-bars, or a massy circular rim, be connected with the machinery, all these inconveniences will be removed. As every fly-wheel must revolve with great rapidity, the momentum of its circumference must be very considerable, and will consequently resist every attempt either to accelerate or retard its motion. When the machine, therefore, has been put in motion, the fly-wheel will be whirling with an uniform celerity, and with a force capable of continuing that celerity when there is any relaxation in the impelling power. After a short rest the animal renews his efforts, but the machine is now moving with its former velocity, and these fresh efforts will have a tendency to increase the velocity; the fly, however, now acts as a

resisting power, receives the greatest part of the superfluous motion, and causes the machinery to preserve its original celerity. In this way the fly secures to the engine an uniform motion, whether the animal takes occasional relaxation, or exerts his force with redoubled ardour.

"In machines built upon a large scale, there is no necessity for the interposition of a fly, as the *inertia* of the machinery supplies its place, and resists every change of motion that may be generated by an unequal admission of the corn.

"A variation in the velocity of engines arises also from the nature of the machinery. Let us suppose that a weight of 1000 pounds is to be raised from the bottom of a well fifty feet deep, by means of a bucket attached to an iron chain which winds round a barrel or cylinder; and that every foot in length of this chain weighs two pounds: it is evident that the resistance to be overcome in the first moment is 1000 pounds, added to 50 pounds, the weight of the chain; and that this resistance diminishes gradually, as the chain coils round the cylinder, till it becomes only 1000 lbs., when the chain is completely wound up. The resistance therefore decreases from 1050 to 1000 pounds; and if the impelling power is inanimate, the velocity of the bucket will gradually increase; but if an animal is employed, it will generally proportion its action to the resisting load, and must therefore pull with a greater or less force, according as the bucket is near the bottom or top of the well. In this case, however, the assistance of a fly may be dispensed with, because the resistance diminishes uniformly, and may be rendered constant, by making the barrel conical, so that the chain may wind upon the part nearest the vertex at the commencement of the motion, the diameter of the barrel gradually increasing as the weight diminishes. In this way the variable resistance will be equalized much better than by the application of a fly-wheel; for the fly, having no power of its own, must necessarily waste the impelling power.

"When machinery is driven by a single stroke steam-engine, there is such an inequality in the impelling power, that, for two or three seconds, it does not act at all. During this interval of inactivity, the machinery would necessarily stop, were it not impelled by a massy fly-wheel of a great diameter, revolving with rapidity, till the moving power again resumes its energy.

"If the moving power is a man acting with a handle or winch, it is subject to great inequalities. The greatest force is exerted when the man pulls the handle upwards from the height of his knee, and he acts with the least force when the handle, being in a vertical position, is thrust from him in a horizontal direction. The force is again increased when the handle is pushed downwards by the man's weight, and it is diminished when the handle, being at its lowest point, is pulled towards him horizontally. But when a fly is properly connected with the machinery, these irregular exertions are equalized, the velocity becomes uniform, and the load is raised with an equable and steady motion.

"In many cases, where the impelling force is alternately augmented or diminished, the performance of the machine may be increased by rendering the resistance unequal, and accommodating it to the inequalities of the moving power, Dr. Robison observes, that 'there are some beautiful specimens of this kind of adjustment in the mechanism of animal bodies.'

"Besides the utility of fly-wheels as regulators of machinery, they have been employed for accumulating or collecting power. If motion is communicated to a fly-wheel by means of a small force, and if this force is continued till the wheel has acbuired a great velocity, such a quantity of motion will be accumulated in its circumference as to overcome resistances, and produce effects, which could never have been accomplished by the original force. So great is this accumulation of power, that a force equivalent to 20 pounds, applied for the space of 37 seconds to the circumference of a cylinder, 20 feet diameter, which weighs 4713 pounds, would, at the distance of one foot from the centre, give an impulse to a musket-ball equal to what it receives from a full charge of gunpowder. In the space of six minutes and ten seconds, the same effect would be produced, if the cylinder was driven by a man who constantly exerted a force of [illegible]0 pounds at a winch one foot long.

"This accumulation of power is finely exemplified in the sling. When the thong which contains the stone is swung round the head of the slinger, the force of the hand is continually accumulating in the revolving stone, till it is discharged with a degree of rapidity which it could never have received from the force of the hand alone. When a stone is projected from the hand itself, there is even then a certain degree of force accumulated, though the stone only moves through the arch of a circle. If we fix the stone in an opening at

the extremity of a piece of wood two feet long, and discharge it in the usual way, there will be more force accumulated than with the hand alone, for the stone describes a larger arch in the same time, and must therefore be projected with greater force.

"When coins or medals are struck, a very considerable accumulation of power is necessary, and this is effected by means of a fly. The force is first accumulated in weights fixed in the end of the fly; this force is communicated to two levers, by which it is farther condensed; and from these levers it is transmitted to a screw, by which it suffers a second condensation. The stamp is then impressed on the coin or medal by means of this force, which was first accumulated by the fly, and afterwards augmented by the intervention of two mechanical powers.

"Notwithstanding the great advantages of fly-wheels, both as regulators of machines and collectors of power, their utility wholly depends upon the position which is assigned them, relative to the impelled and working points of the engine. For this purpose no particular rules can be laid down, as their position depends altogether on the nature of the machinery. We may observe, however, in general, that when fly-wheels are employed to regulate machinery, they should be near the impelling power; and when used to accumulate force in the working point, they should not be far distant from it. In hand-mills for grinding corn, the fly is, for the most part, very injudiciously fiqed on the axis to which the winch is attached; whereas it should always be fastened to the upper millstone, so as to revolve with the same rapidity. In the first position, indeed, it must equalize the varying efforts of the power which moves the winch; but when it is attached to the turning millstone, it not only does this, but contributes very effectually to the grinding of the corn.

"Dr. Desaguliers mentions an instance of a blundering engineer, who applied a fly-wheel to the slowest mover of the machine, instead of the swiftest. The machine was driven by four men, and when the fly was taken away, one man was sufficiently able to work it. The error of the workman arose from his conceiving, like many others, that the fly added power to the machine; but we presume that Dr. Desaguliers himself has been accessory to this general misconception of its nature, by denominating it a *mechanical power*. By the interposition of a fly, however, as the Doctor well knew, we gain no mechanical force; the impelling power, on the contrary, is wasted, and the fly itself even loses some of the force which it receives, by the resistance of the air."

Lond. Mec. Mag.

MODE OF DIGGING A CANAL DURING FROST.

The Polish general, Sokolnicki, has given to the public an account of the manner he pursued in making a canal in the middle of winter, when the earth was frozen very deep, for the purpose of draining some ground in Poland.

The canal was traced out in autumn with a strong plough; the borders were dug out three or four feet deep, and the space filled up with dung and a considerable quantity of straw; the surface was also divided by the plough into squares of three feet, for the purpose of determining the size of the blocks of earth which he intended should be removed; and lastly, he prepared, at certain distances, inclined planes, that the sledges might go down to the bottom of the intended canal, which was to be four or five feet deep.

When the winter was set in, the ground sufficiently frozen and covered with snow, the excavation of the canal was begun. The workmen were directed to dig, with long pick-axes, trenches running horizontally under the frozen ground, and to introduce a sledge; wedges were then driven in the furrows that had been made by the plough when the ground was divided into squares; and the block being thus separated, settled upon the sledge, and was drawn away immediately by teams of horses, and placed on the neighbouring fields to serve as manure.

In this manner he completed in three weeks, at the expense of about 280 pounds, a canal, for the execution of which, by contract, he had been asked upwards of 4000 pounds sterling.

Lond. Mec. Jour.